

NOTES ON RODENTS AND MARSUPIALS AND THEIR ECTOPARASITES COLLECTED IN AUSTRALIA IN 1974-75

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Summary

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One monotreme species, twenty species of marsupials and twenty-seven species of rodents were taken during a collecting trip in eastern, western and northern Australia between October 1974 and July 1975. Information is provided on localities, dates, sexes and habitat-type of all species. Extensions of known ranges were recorded for *Rattus villosissimus*, *Zygomys argurus*, *Pseudomys delicatulus* and *P. gracilicaudatus*. Data on the present location of specimens collected, observations on the reproductive condition of animals noted in the field and the ectoparasites collected are included. Comments are made on the low population densities of small mammals in Australia and the low number of species occurring sympatrically.

Introduction

The distribution and habitat preferences of the small mammal fauna of Australia is still very poorly known. Important contributions in this field include—Harrison (1961) and Tate (1952) for Qld, Calaby (1966) and Marlow (1958) for N.S.W., Wood Jones (1923) and Finlayson (1961) for south and central Australia, Bannister (1969) and Glauert (1933) for W.A., and Calaby & Keith (1974), Johnson (1964) and Parker (1973) for the N.T. In addition Taylor & Horner (1973) provided information on all Australian species of the genus *Rattus*.

A. C. Robinson and J. F. Robinson made a collecting trip between October 1974 and July 1975 in eastern, western and northern Australia. The aim was to collect as many different rodent taxa as possible during the time available, primarily for studies of their karyotypes and blood proteins. Trapping localities were therefore chosen to maximise the chances of capturing specific species, and this generally involved visiting known occurrences rather than trapping in new areas. Overall sampling was therefore not systematic throughout the

areas covered by the survey, but in any one locality efforts were made to sample the major recognisable habitats. This resulted in the capture of a number of small mammals other than rodents and details of these are included. In addition the ectoparasites collected from each species are recorded.

Companion papers record the results of an analysis of the karyotypes (Baverstock *et al.* 1975, 1976, 1977a,b,c), the blood proteins, the diet (Watts 1977), and the habitat, of most of the rodents collected. In addition some rare and little known ectoparasite taxa will be discussed in more detail in future papers by the relevant authorities listed in the Acknowledgments.

Methods

The route followed on the collecting trip started at Windorah, Queensland, to Cairns, then north up Cape York Peninsula as far as Portland Roads, south through coastal Queensland with a visit to Emerald, then through coastal N.S.W. (with a visit to Mt Kosciusko), through coastal Victoria (with a visit to the Grampians) and then to Adelaide.

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Fig. 1. Localities mentioned in the text.

Collecting on the second half of the trip began in the southwest of W.A., then north following the coast to Broome and Derby; a visit to the King Leopold Ranges then, via Wyndam, to Darwin, N.T. From Darwin trips were made east to Nourlangie Camp on the edge of Arnhem Land 205 km E, and south to the Reynolds River. Figure 1 gives the place names mentioned in the text. Most species were collected in live traps although some information is included on road kills. Forty Sherman folding aluminium traps, forty wire mesh cage traps 13 cm x 13 cm x 35 cm, and ten wire mesh cage traps 30 cm x 25 cm x 45 cm were used. As many of these traps as practicable were set at each locality. Traps were placed 20 m apart in lines of twenty traps, with Sherman and small cage traps alternating. The large cage traps were used only when attempts were made to capture large species, i.e. *Hydromys*, *Mesembriomys* etc. The bait used was a mixture of peanut paste and rolled oats. Normally traps were left down for two nights in any one location, although shorter and longer periods were employed, depending on the species of rodent we were attempting to catch. Altogether traps were set on 150 nights for a total of approximately 9,500 trap nights.

The nomenclature used follows Ride (1970) with the exception of the genus *Rattus* which is that of Taylor & Horner (1973), as modified by Baverstock *et al.* (1975).

Field identifications were checked in Adelaide, using karyotypic as well as morphological characters. This was particularly important in *Rattus* where several species are difficult to identify while alive, but readily

separated on their karyotypes. In the case of Queensland *Melomys* we have followed the unsatisfactory convention that only two species are involved: that small animals caught in grassland are *M. littoralis*, and slightly larger ones caught in closed forest are *M. cervinipes*. However, some individuals could not be classified in this manner and these are simply listed as *Melomys* sp. The Northern Territory *Melomys* have been included in *M. littoralis* provisionally on karyotypic evidence.

The bulk of the paper contains a tabulation of localities where all the various small mammals were caught. Many of these animals were released subsequently at the points of capture. They are treated species by species and the following information is recorded: species name, common name, specific locality, latitude south and longitude east, number of individuals caught (males, females, unsexed), date, specimen registration numbers, notes on habitat, reproductive condition and ectoparasites. Localities are given as km on a compass bearing from a recognisable town. Latitudes and longitudes pinpoint the locality more precisely. Localities were regarded as separate when they differed by more than one minute of latitude or longitude. No year is given following the date of collection but all dates fall within the period October 1974 to July 1975. As many of the rodents are still alive at the Institute of Medical & Veterinary Science at the time of publication, a dual system of specimen numbers is introduced. All specimens have been assigned an I.M.V.S. publication number and a list of these will be lodged at the South Australian Museum, and periodically updated. Where specimens have already been placed in museums, the appropriate museum registration number is recorded. Museum abbreviations used are: NMV, National Museum of Victoria; QM, Queensland Museum; WAM, Western Australian Museum; AM, Australian Museum; SAM, South Australian Museum. I.M.V.S. publication numbers have no prefix. Habitat notes follow the vegetation classification of Specht (1970) and Specht *et al.* (1974), to the level of structural formation.

Results

MONOTREMATA

FAMILY TACHYGLOSSIDAE

1. *Tachyglossus aculeatus*, Echidna

Localities: Qld (i) Maslin Ck, Atherton, 17°15' 145°30' E, 21 Nov. (ii) 26 km NW Townsville, 19°9' 146°36', 1, 9 Dec.

Notes: One specimen (i) was trapped near a creek bank in a cultivated paddock; the other (ii) on beach dunes covered by low open shrubland.

MARSUPIALIA

FAMILY MACROPODIDAE

2. *Thylogale stigmatica*, Red-legged Pademelon
Localities: *Qld* (i) 72 km S Mt Garnett, 18°14' 144°46', 1, 21 Oct., QM 712. (ii) 4 km S Atherton, 17°18' 145°29', 1, 21 Oct., QM 702.

Notes: Both road kill victims. Skulls only collected. Adjacent to open grassy woodland (i) and adjacent to closed forest (ii).

3. *Onychogalea unguifera*, Northern Nail-tailed Wallaby

Locality: *W.A.* (i) 19 km SW Wyndham, 16°35' 128°14', 1, 27 May.

Notes: A road kill specimen, skull only collected. Adjacent to open grassy woodland.

4. *Lagorchestes conspicillatus*, Spectacled Hare-wallaby

Localities: *Qld* (i) 74 km N Dajarra, 21°10' 139°40', 1, 8 October. (ii) 15 km S Mareeba, 17°3' 145°26', 1♀, 21 Oct., QM 710.

Notes: Both road kills. Parts of the skull of (i) and the complete skull of (ii) were collected. Adjacent to tall open shrubland (i) and open grassy woodland (ii).

5. *Lagorchestes hirsutus*, Western Hare-wallaby

Locality: *W.A.* (i) Bernier Island, 24°56', 113°9', 4, 20 Apr.

Notes: Four specimens were seen while spot-lighting on foot in hummock grassland. (Robinson *et al.* 1976.)

6. *Aepyprymnus rufescens*, Rufous Rat-kangaroo

Locality: *Qld* (i) 35 km S Proserpine, 20°40' 148°35', 1♂, 11 Dec., QM 708.

Notes: A road kill specimen. A complete specimen was collected. Adjacent to open grassy woodland.

7. *Bettongia lesueur*, Boodie

Locality: *W.A.* (i) Bernier Island, 24°55' 113°9', 1♀, 22 Apr.

Notes: Trapped on the edge of the island platform in low shrubland (Robinson *et al.* 1976).

Reproduction: (i) 1 pouch young C-R length 165 cm.

8. *Potorous tridactylus*, Potoroo

Locality: *Vic.* (i) 6 km SW Bemm River, 37°47' 148°54', 1, 20 Feb.

Notes: Trapped in low open forest/closed heath habitat.

FAMILY PHALANGERIDAE

9. *Trichosurus vulpecula*, Brush-tailed Possum

Localities: *Qld* (i) 28 km N Atherton, 17°2' 145°26', 3, 21-22 Nov. (ii) 6 km N Atherton, 17°5' 145°29', 1♀, 23 Nov., QM 714.

Notes: Locality (i) was a garden shed, surrounded by open grassy woodland. The road kill specimen (ii) was adjacent to a road-side strip of closed forest.

FAMILY PERAMELIDAE

10. *Isodon obesulus*, Short-nosed Bandicoot

Locality: *Vic.* (i) 40 km SE Melbourne, 38°15' 145°14', 1, 27 Feb.

Notes: Trapped in low open forest.

11. *Isodon macrourus*, Brindled Bandicoot

Localities: *Qld* (i) 112 km SW Mt Garnett, 18°36' 144°44', 1♂, 21 Nov. (ii) 7 km SW Portland Roads, 12°40' 143°23', 1♂, 2 Nov., QM 713. (iii) 25 km S Cooktown, 15°41' 145°13', 1♂, 7 Nov. (iv) 8 km SW Townsville, 19°20' 146°4', 2, 7 Dec. (v) 26 km NW Townsville, 19°9' 146°36', 3, 9 Dec. (vi) 58 km N Maryborough, 25°6' 152°32', 1♀, 14 Jan. *N.S.W.* (vii) 20 km SW Port Macquarie, 31°37' 153°50', 1♀, 1 Feb. *N.T.* (viii) 185 km E Darwin, 12°41' 132°55', 18, 15-17 June. (ix) Vicinity of Nourlangie Camp, 12°50' 132°41', 12°46' 132°40', 12°53' 132°38', 12°54' 132°38', 6, 18-19 June.

Notes: Trapped in a variety of habitats—closed sedgeland (vi), open grassy forest (i), low grassy woodland (iii, ix), low open grassy woodland (iv, viii, ix), closed scrub (vii) and low open shrubland on beach dunes (v). A road kill specimen was collected adjacent to open grassy forest (ii). Reproduction: (vi) (viii) 2 unfurred pouch young.

Ectoparasites: (i, iii) *Xenopsylla vexabilis*.

12. *Perameles nasuta*, Long-nosed Bandicoot

Locality: *Qld* (i) 98 km NW Bundaberg, 24°31' 151°28' 2, 10-11 Jan.

Notes: Trapped in closed forest.

Reproduction: (i) 2 independent juveniles trapped.

13. *P. bougainville*, Barred Bandicoot

Locality: *W.A.* (i) Bernier Island, 24°56' 113°9', 1♂, 2♀, 5, 21-22 Apr.

Notes: Five individuals were seen at night in low shrubland. Three individuals were captured in cage traps (Robinson *et al.* 1976).

Reproduction: (i) 2 pouch young C-R length 7 cm.

FAMILY DASYURIDAE

14. *Dasyurus hallucatus*, Little Northern Native-Cat

Localities: *Qld* (i) Coen, 13°56' 143°12', 1 ♀, 28 Oct. (ii) 23 km S Cooktown, 15°11' 145°12', 1 ♂, 10 Nov., QM 707, N.T. (iii) Nourlangie Rock, 230 km E Darwin, 12°52' 132°49', 1, 13 June. (iv) 185 km E Darwin, 12°41' 132°55', 5, 15–17 June. (v) 24 km NE Nourlangie Camp, 12°41' 132°37', 1 ♂, 15 June. (vi) 14 km S Nourlangie Camp, 12°54' 132°38', 1, 9 June.

Notes: Localities (iv) and (vi) were low grassy woodland, (ii) and (v) were road kill victims on roads through low grassy woodlands. Nourlangie Rock is an outlying formation of the Arnhem Land Escarpment and can best be described as a "rock-pile". The specimen from Coen was caught in a feed shed and donated by a local resident.

Reproduction: (i) Lactating female.

Ectoparasites: (i) *Xenopsylla vexabilis*, *Echidnophaga myrmecobii*.

15. *Dasyuroides byrnei*, Byrne's Pouched-mouse

Locality: *Qld* (i) 75 km SE Boulia, 15°32' 140°7', 1, 17 Oct.

Notes: One animal was seen at night on a flood plain covered with tussock grassland.

16. *Antechinus stuartii*, Brown Antechinus

Localities: *N.S.W.* (i) 20 km SW Port Macquarie, 31°37' 152°52', 1 ♂, 2 Feb. (ii) 56 km SE Canberra, 35°41' 149°32', 1 ♂ 2 ♀, 14 Feb., AM M10430. (iii) 20 km NE Murrumbidgee 37°37' 149°57', 1 ♀, 1, 17 Feb. *Vic.* (iv) 6 km SW Bemm River, 37°47' 148°54', 1 ♂, 20 Feb. (v) 40 km SE Melbourne, 38°15' 145°14', 9, 26–27 Feb. (vi) 38 km E Melbourne, 37°53' 145°22', 9, 1–2 Mar. (vii) 12 km SW Apollo Bay, 38°47' 143°32', 12, 3 Mar. (viii) 73 km NE Hamilton, 37°18' 142°36', 6, 7 March.

Notes: *A. stuartii* was captured in a variety of habitats: closed scrub (i), open forest (ii), woodland/closed heath (iii), low open forest/closed heath, (iv), low open forest (v), tall open forest (vi, vii), and closed heath (viii). It appears to be associated with a dense understorey regardless of canopy height.

Ectoparasites: (ii) *Pygiopsylla rainbowii* n.ssp., *Acanthopsylla rothschildi* ssp.

17. *Antechinus bellus*, Fawn Antechinus

Localities: *N.T.* (i) Nourlangie Rock, 230 km E Darwin, 12°52' 132°49', 1, 13 June. (ii) 185 km E Darwin, 12°41' 132°55', 6 ♂, 1 ♀, 15–17 June, 563, 564. (iii) 1 km S Nourlangie Camp, 12°46' 132°40', 1 ♂, 19 June. (iv) 10 km S Nourlangie Camp, 12°51' 132°41', 1 ♂, 20 June, 479. (v) 12 km S Nourlangie Camp, 12°53' 132°38', 1 ♂, 18 June. (vi) 14 km S Nourlangie Camp, 12°54' 132°38', 1 ♂, 18 June.

Notes: With the exception of Nourlangie Rock all localities were woodland habitats. Nourlangie Rock is an outlying rock of the Arnhem Land escarpment surrounded by low grassy woodland.

18. *Antechinus godmani*, Godman's Antechinus
Locality: *Qld* (i) 39 km S Innisfail, 17°52' 146°4', 1 ♂, 5 Dec.

Notes: Caught in closed forest.

Reproduction: 1 independent subadult trapped.

Ectoparasites: *Acanthopsylla pavida*.

19. *Antechinus swainsonii*, Dusky Antechinus

Localities: *N.S.W.* (i) Kosciusko Natl Pk, 36°23' 148°28', 3 ♂, 4, 10–11 Feb. (ii) 54 km SE Canberra, 35°39' 149°32', 1 ♂, 14 Feb. (iii) 56 km SE Canberra, 35°41' 149°32', 1 ♂, 14 Feb. *Vic.* (iv) 6 km SW Bemm River, 37°47' 148°54', 1 ♀, 20 Feb. (v) 38 km E Melbourne, 37°53' 145°22', 5, 1–2 Mar. (vi) 12 km SW Apollo Bay, 38°47' 143°32', 1, 3 Mar. (vii) 73 km NE Hamilton, 37°18' 142°36', 1, 7 Mar.

Notes: Caught in a variety of habitats: closed grassland (i), open forest (iii), low open forest/closed heath (iv), tall open forest (v, vi) and closed heath (vii).

Ectoparasites: (ii) *Pygiopsylla hoplia*, *Acanthopsylla rothschildi* ssp., (iv) *A. rothschildi* ssp.

20. *Sminthopsis rufigenis*, Red-cheeked Dunnart

Locality: *Qld* (i) 23 km S Portland Roads 120°47' 143°18', 1 ♂, 2 Nov., QM 728.

Notes: Caught in low open forest/grassy woodland.

21. *Sminthopsis crassicaudata*, Fat-tailed Dunnart

Locality: *Qld* (i) 70 km SE Boulia, 15°28' 140°4' 1 ♂, 17 Oct., 520.

Notes: Caught on a flood plain in an area of tussock grassland.

RODENTIA

FAMILY MURIDAE

22. *Rattus fuscipes fuscipes*, Southern Bush-rat

Localities: *W.A.* (i) 30 km NW Augusta, 34°4' 115°2', 2 ♂, 1 ♀, 6 Apr., WAM M15265-M15267, (ii) 22 km NE Jurien, 30°8' 115°8', 3 ♂, 6 ♀, 12–13 Apr., WAM M15268-M15271 425, 426, 427, 429, 522.

Notes: Locality (i) was a low open woodland/closed heath formation and (ii) a closed heath formation.

Ectoparasites: (ii) *Mesolaelaps australensis*, *Xenopsylla vexabilis*.

23. *Rattus f. assimillis*, Southern Bush-rat

Localities: *Qld* (i) 38 km E Kingaroy, 26°39' 152°13', 1 ♂ 4 ♀, 16 Jan., 236, 368. *N.S.W.* (ii) 11 km NE Nimbin, 28°32' 153°18', 1 ♂ 1 ♀, 1, 29 Jan., AM M10401-M10403, (iii) 50 km NE Newcastle, 32°39' 152°9', 1 ♂ 1 ♀, 3 Feb., AM M10404, M10414. (iv) Kosciusko Natl Pk, 36°23' 148°28', 6 ♂, 5 ♀, 10–11 Feb. (v) 54 km SE Can-

berra, 37°39' 149°32', 2 ♂, 4 ♀, 14 Feb., AM M10408-M10413, (vi) 56 km SE Canberra, 35°41' 149°32', 4 ♀, 14 Feb., AM M10405-M10407, 383, (vii) 20 km NE Mallacoota, 37°27' 149°57', 6 ♂, 9 ♀, 16-17 Feb., *Vic.* (viii) 1 km SW Bemm River, 37°46' 148°58', 1 ♀, 20 Feb. (ix) 3 km SW Bemm River, 37°47', 148°56', 1, 21 Feb. (x) 5 km SW Bemm River, 37°47' 148°5', 4 ♂, 3 ♀, 19-20 Feb., 281-285, 296, 388, (xi) 6 km SW Bemm River, 37°47' 148°54', 1 ♂, 1 ♀, 4, 20-21 Feb. (xii) 38 km E Melbourne, 37°53' 145°22', 5 ♂ 3 ♀, 28 Feb.-1 Mar., 292, 394-399, (xiii) 12 km SW Apollo Bay, 38°47' 143°32', 7 ♂, 6 ♀, 7, 3 Mar., 211, 293, 246, 400-404.

Notes: Caught in closed forest (i and ii), open forest (iii, v and vi), closed grassland (iv), woodland/closed heath (vi), low open forest/closed heath (vii), closed scrub (vii) and tall open forest (vii and ix).

Reproduction: (ii, iv, xii, xiii) Independent juveniles caught.

Ectoparasites: (i, vii, x) *Laelaps assimilis*, (i, iv, vi, vii) *Laelaps* sp., (vi, vii) *Mesolaelaps bandicoata*, (vii) *Guntheria taylorae*, (i, iv) *Macropsylla hercules*, (iv) *Pygiopsylla gravis* or n.sp., (iv, vi, vii) *P. hoplia*, (iv, v, vii) *P. rainbowii*, (i) *P. sp.*, (ii) *Acanthopsylla incerta*, (v, vi) *A. rothschildi* ssp., (iv) *Stephanocircus concinnus*, (vii) *S. peclinipes*.

24. *Rattus f. coracius*, Southern Bush-rat

Localities: *Qld* (i) 14 km E Atherton, 17°15' 145°37', 1 ♂, 2 ♀, 28 Nov., QM 2103, 2121, 347, (ii) 41 km SE Cairns, 17°15' 145°46', 4 ♂, 6 ♀, 16 Nov., QM2100, 2106, 2108, 2124, 2126, 354-357.

Notes: Both localities were closed forest.

Reproduction: (ii) 3 young born.

Ectoparasites: (i) *Pygiopsylla sinuata*, *Acanthopsylla puvida*, *Stephanocircus dasyuri*, *Metastivilius rectus*, (ii) *Mesolaelaps australiensis*.

25. *Rattus lutreolus*, Swamp-rat

Localities: *Qld* (i) 29 km E Warwick, 28°16' 152°19', 1 ♀, 1, 24 Feb., 367. *N.S.W.* (ii) 20 km SW Port Macquarie, 31°37' 152°50', 6 ♂, 5 ♀, 1-2 Feb., AM M10422-M10428, 373-375, 376, 377, 387, 497, 523, 524, (iii) 20 km NE Mallacoota, 37°27' 149°57', 2 ♀, 17-18 Feb. AM M10429, 376, 377, 387, 497, 523, 524. *Vic.* (iv) 3 km SW Bemm River, 37°47' 148°56', 4 ♂, 1 ♀, 20-21 Feb., 286, 410, (v) 6 km SW Bemm River, 37°47', 148°54', 1 ♂, 4 ♀, 1, 20-21 Feb., 287, 389-391, (vi) 38 km E Sale, 38°6' 147°31', 1 ♀, 23 Feb., 393, (vii) 40 km SE Melbourne, 38°15' 145°14', 5 ♂, 26-27 Feb., NMV C15684-15688, 405, (viii) 37 km NE Hamilton, 37°35' 142°24', 1 ♂, 4 Mar. (ix) 42 km NE Hamilton, 37°32' 142°25', 2 ♀, 7 Mar., 407, 408, (x) 52 km NE Hamilton, 37°27' 142°28', 1 ♀, 7 Mar.,

NMV C15695, (xi) 53 km NE Hamilton, 37°26' 142°29', 1 ♀, 5 Mar., 409, (xii) 73 km NE Hamilton, 37°18' 142°36', 2 ♀, 6-7 Mar., NMV C15694, 294.

Notes: *R. lutreolus* was usually associated with damp soil. Habitats were woodland (i), closed scrub (ii and iv), woodland/closed heath (iii), closed heath (vi, vii, x, xi, xii), low open woodland/open heath (vi) and low open forest (vii). Reproduction: (v) 6 young born, independent juveniles trapped.

Ectoparasites: (ii) *Laelaps nuttalli*, *Mesolaelaps australiensis*, (v) *M. bandicoata*, (ii, v) *Pygiopsylla hoplia*, (v) *P. sp.*, *Acanthopsylla rothschildi* ssp.

26. *Rattus sordidus*, Dusky Field-rat

Localities: *Qld* (i) 23 km S Portland Roads, 12°47' 143°18', 5 ♂, 4 ♀, 2-3 Nov., QM 2109, 2128, 327, 498-500, 525, (ii) 37 km S Cooktown, 15°48' 145°14', 3 ♂, 2 ♀, 9 Nov., 206, 334-337, (iii) 16 km S Cairns, 17°4' 145°47', 4 ♂, 2 ♀, 14 Nov., QM 720, 2110-2112, 258, 358, (iv) 17 km S Cairns, 17°5' 145°47', 2 ♂ 1 ♀, 14 Nov., (v) 22 km SE Atherton, 17°22' 145°33', 2 ♂, 3 ♀, 29 Nov., QM 2102, 253, 348-350, (vi) 11 km NE Atherton, 17°12' 145°33', 11 ♂ 3 ♀, 2, 22 Nov., QM 2105, 2107, 501-504, (vii) 29 km SE Innisfail, 17°46' 146°7', 1, 3 Dec.

Notes: In natural situations *R. sordidus* was caught in the following habitats: low open forest/grassy woodland (i), low grassy woodland (ii), closed sedgeland (v), low open grassy woodland (iv) and open forest (vii). Locality (vi) was a cane field/closed grassland and locality (iii) was a cultivated paddock/closed grassland.

Reproduction: (ii) Independent juvenile trapped.

Ectoparasites: (i, iii, vi) *Laelaps nuttalli*, (i) *L. sp.*, (i, ii, iii, vi) *Mesolaelaps australiensis*, (i, iv, v, vi) *Pygiopsylla hoplia*, (i, v, vi) *P. rainbowii* n. ssp., (v, vi) *Stephanocircus dasyuri*, (vi) *Xenopsylla australiaca*, *X. australiacus*, (i, ii, vi) *X. vexabilis*.

27. *Rattus colletti*, Northern Bush-rat

Localities: *N.T.* (i) 175 km E Darwin, 12°42' 132°32', 8 ♂, 7 ♀, 7-8 Jun., SAM M9900, M9902, 448-460, (ii) 15 km NE Darwin, 12°33' 130°56', 4 ♂, 5 ♀, 11 June, SAM M9901, 461-463, 465, 466.

Notes: Both localities were closed sedgeland.

Ectoparasites: (i, ii) *Laelaps nuttalli*.

28. *Rattus villosissimus*, Plague Rat

Localities: *Qld* (i) 56 km SE Boulia, 15°22' 140°0', 2 ♂, 3 ♀, 1, 18 Oct., 311-313, (ii) 72 km SE Boulia, 15°29' 140°8', 1, 17 Oct. (iii) 77 km SE Boulia, 15°35' 140°8', 1 ♂, 17 Oct., 310, (iv) 32 km W Windorah, 25°20' 142°18', 5 ♂, 15 Oct., 306-309, (v) 2 km NE Mt Isa, 20°38' 139°30', 1 ♂, 3 ♀, 19 Oct., 314-316, (vi) 33 km

SE Richmond, 2°49' 143°28'. 1 ♂, 1 ♀, 20 Oct., 317, 318. *W.A.* (vii) 26 km SE Wyndham, 15°35' 128°6', 1 ♂, 25 May, 441.

Notes: Caught on gibber plain (i), flood plains covered with tussock grassland, (ii, iii, vi, iv), grassy woodland (v) and closed tussock grassland (vii).

Reproduction: (i) Independent juvenile trapped.

Ectoparasites: (i, iii, iv, v, vi) *Laelaps nuttalli*, (iv, v) *Mesolaelaps australiensis*, (i, iii, v, vi) *Xenopsylla vexabilis*.

29. *Rattus l. leucopus*, Mottled-tailed Cape York Rat

Localities: Qld (i) 19 km SW Portland Roads, 12°43' 143°17', 3 ♂, 3 ♀, 1-3 Nov., QM 2116, 323, 324, 326, 328. (ii) 20 km SW Portland Roads, 12°44' 143°16', 4 ♂, 4 ♀, 31 Oct.-1 Nov., QM 729, 2115, 2127, 236, 319-321. (iii) 24 km SW Portland Roads, 12°47' 143°18', 1 ♀, 31 Oct. (iv) 26 km SW Portland Roads, 12°44' 143°14', 1 ♂, 31 Oct. (v) 27 km Portland Roads, 12°49' 143°18', 1 ♂, 1 ♀, 2 Nov.

Notes: All localities were closed forest.

Reproduction: (ii) Female with 5 embryos in uterus, independent juvenile trapped.

Ectoparasites: (i, ii, iii, iv, v) *Laelaps* sp.

30. *Rattus leucopus cooktownensis*, Mottled-tailed Cape York Rat

Localities: Qld (i) 32 km S Cooktown, 15°45' 145°18', 2 ♂, 4 ♀, 6-7 Nov., QM 719, 329-332, 339. (ii) 17 km E Atherton, 17°15' 145°38', 2, 29 Nov.

Notes: Both localities were closed forest.

Ectoparasites: (i) *Laelaps* sp.

31. *Rattus t. tunneyi*, Tunney's Rat

Localities: *W.A.* (i) 165 km E Derby, 17°6' 125°10', 1 ♂, 2 ♀, 15-16 May, 431-433. (ii) 165 km E Derby, 17°7' 125°10', 1 ♂, 17 May, 436. (iii) 174 km E Derby, 17°10' 125°16', 1 ♂, 1 ♀, 18 May, WAM M15303, M15304. (iv) 246 km E Derby, 17°7', 125°43', 2 ♀, 20 May, 438, 527. (v) 26 km E Wyndham, 15°35' 128°6', 2 ♂, 1 ♀, 25 May, WAM M15308, 442, 526. *N.T.* (vi) Nourlangie Camp, 12°46' 132°40', 1 ♂, 1 ♀, 2, 18-19 June, SAM M9912, M9911. (vii) 1 km S Nourlangie Camp, 12°46' 132°40', 1 ♀, 1, 18-19 June, 471. (viii) 7 km SE Nourlangie Camp, 12°49' 132°42', 3 ♂, 13 June, SAM M9907, 467, 469. (ix) 8 km S Nourlangie Camp, 12°49' 132°40', 1, 19 June. (x) 9 km S Nourlangie Camp, 12°50' 132°41', 1 ♂, 26, 18-20 June, 529. (xi) 10 km S Nourlangie Camp, 12°51' 132°41', 10, 18-19 June. (xii) 14 km S Nourlangie Camp, 12°54' 132°39', 2 ♂, 3 ♀, 5, 18-19 June, 474-476. Notes: Caught in closed tussock grassland (i, ii, iii, iv, v), low woodland/closed tussock grassland (iv), low closed forest (vi), low grassy

woodland (vii, viii, ix, xi, xiii), and low open grassy woodland (xii).

Ectoparasites: (viii) *Laelaps nuttalli*, (xi) *Mesolaelaps australiensis*.

32. *Rattus tunneyi culmorum*, Tunney's Rat

Localities: Qld (i) 22 km SW Emerald, 23°41' 148°4', 1 ♂, 15 Dec., 363. (ii) 58 km N Rockhampton, 22°52' 150°41', 1 ♂, 5 Jan., QM 2101. (iii) 58 km N Maryborough, 25°6' 152°33', 14 Jan., QM 2098.

Notes: Caught in closed grassland (i), low open forest (ii) and grassy woodland (iii).

Ectoparasites: (ii) *Laelaps* sp., (iii) *Mesolaelaps australiensis*, (i) *Xenopsylla vexabilis*.

33. *Rattus rattus*, Black Rat

Localities: Qld (i) 13 km N Laura, 15°12' 144°25', 2 ♂, 28 Oct., QM 705. (ii) 17 km S Cairns, 17°5' 145°47', 1 ♀, 14 Nov., 360. (iii) 40 km SE Cairns, 17°15' 145°56', 2 ♂, 1 ♀, 16 Nov., 351-353. (iv) 11 km NE Atherton, 17°12' 145°33', 1 ♂, 1 ♀, 22 Nov., 340-341. (v) Maslin Creek, Atherton, 17°15' 145°29', 1 ♂, 1 ♀, 22-23 Nov., 339, 342. (vi) 3 km SE Atherton, 17°20' 145°30', 1 ♂, 1 ♀, 27 Nov., 345, 346. (vii) 58 km N Maryborough, 25°6' 152°32', 1 ♀, 14 Jan., QM 717. (viii) Mogill Creek, Brisbane, 27° 12' 152°56' 1 ♂, 1 ♀, 27 Jan., 369, 370. *N.S.W.* (ix) 50 km NE Newcastle, 32°39' 152°9', 4 ♂, 2 ♀, 3-4 Feb., AM M10415-M10418, 379. (x) 25 km NW Canberra, 35°9' 148°57', 1 ♂, 1 ♀, 9 Feb., AM M10419, M10420. *W.A.* (xi) 26 km NE Perth, 31°13' 116°9', 1 ♂, 1 ♀, 4 April, WAM M15262, 412. (xii) 30 km NW Augusta, 34°4' 115°2', 1 ♂, 6 May, 414. (xiii) 18 km N Roebourne, 20°36' 117°10', 2 ♀, 9 May, WAM M15263, M15264. *N.T.* (xiv) 114 km S Darwin, 13°20' 130°44', 1 ♂, 3 ♀, 24 June, SAM M9903-M9906.

Notes: Caught in grassy open forest (i), riverine closed forest (ii), low open grassy woodland (iii), mangroves adjacent to closed forest (iii), closed grassland (iv), edge of closed forest (vi), open forest (ix), low open forest/closed heath (xii), rockpile and hummock grassland (xiii) and river banks (v, x, xi, xiv).

Ectoparasites: (ix) *Laelaps assmilis*, (iv) *L. nuttalli* (xi) *Echinonyssus butantanensis*, *Ornithonyssus bacoti*, (iv) *Pygiopsylla rainbowii* n. sp., (xi) *P. tunneyi*, (iv, v) *Xenopsylla australiaca* (iv, vi) *X. vexabilis*, (v, xi) *Leptopsylla segnis*.

34. *Hydromys chrysogaster*, Water Rat

Localities: Qld (i) 63 km NW Coen, 13°26' 142°56', 1 ♂, 29 Oct., QM 698. (ii) 20 km SW Portland Roads, 12°44' 143°16', 2 ♀, 31 Oct.-2 Nov. (iii) 26 km S Portland Roads, 12°49' 143°18', 1 ♀, 2 Nov. (iv) 40 km SE Cairns, 17°15' 145°56', 2 ♀, 15 Nov., QM697. (v) Atherton, 17°15' 145°29', 4 ♂, 1 ♀, 24 Nov., 343, 344, QM 699. (vi) 29 km SE Innisfail, 17°46'

146°7', 2 ♂, 2 ♀, 4 Dec., 192, 193, 362. (vii) 61 km N Rockhampton, 22°51' 150°40', 1 ♂, 5 Jan., 365. (viii) 9 km SE Dunwich, Stradbroke Island, 27°32' 153°30', 1 ♂, 19 Jan., 194. *W.A.* (ix) 26 km NE Perth, 31°13' 116°91', 2 ♂, 1 ♀, 4 Apr., 218, 219, 413. (x) 165 km E Derby, 1 ♂, 1 ♀, 16-17 May, 215, 220.

Notes: All localities were at the water's edge: flowing fresh water (ii, iii, iv, v, vii, viii, ix, x), stagnant (i) and saline (vi).

Ectoparasites: (iii, vi) *Laelaps wasselli*, (v) *Mesolaelaps australiensis*, *Pygiopsylla hoplia*, *Xenopsylla vexabilis*.

35. *Mesembriomys gouldii*, Black-footed Tree-rat

Localities: *Qld* (i) 28 km N Atherton, 17°2' 145°26', 1 ♀, 21 Nov., 87. (ii) 22 km N Atherton, 17°7' 145°26', 1 ♂, 22 Nov., QM 700. *N.T.* (iii) 7 km SE Nourlangie Camp, 12°49' 132°42', 1 ♀, 13 June, 64. (iv) 12 km S Nourlangie Camp, 1 ♂, 18 June, 85. (v) 185 km E Darwin, 12°41' 132°55', 1 ♀, 14 June, 86. (vi) 17 km E Darwin, 12°29' 130°59', 1, 17 June, 531.

Notes: Localities ii and vi were road kills. All localities were low open grassy woodland.

Reproduction: (iii) 2 young born.

36. *Conillurus penicillatus*, Brush-tailed Tree-rat

Localities: *N.T.* (i) 7 km SE Nourlangie Camp, 12°49' 132°42', 1 ♀, 13 June, 90. (ii) 9 km SE Nourlangie Camp, 12°50' 132°41', 1 ♂, 19 June, 88. (iii) 10 km S Nourlangie Camp, 12°51' 132°41', 1 ♀, 20 June, 89.

Notes: Both localities were low grassy woodland.

Reproduction: (i) 3 young born.

37. *Notomys alexis*, Spinifex Hopping-mouse

Localities: *W.A.* (i) 14 km N Denham, 25°49' 113°32', 1 ♀, 19 Apr., WAM M15290. (ii) 14 km N Denham, 25°48' 113°31', 1 ♂, 1 ♀, 26-28 Apr., 166, 168. (iii) 160 km NE Carnarvon, 1 ♀, 13, 7 May, WAM M15291.

Notes: Caught in open scrub (i) and in tall open shrubland (ii). Both areas were on red sand. Judging from tracks in locality (i) and from spotlighting at locality (ii) *N. alexis* appeared to be common at both localities.

38. *Zyzomys argurus*, Common Rock-rat

Localities: *Qld* (i) 22 km S Cooktown, 15°39' 145°13', 3 ♂, 4 ♀, 7-9 Nov., QM 691, 2104, 95, 96, 534. *W.A.* (ii) Fortescue River, 21°18' 116°11', 1 ♂, 4 ♀, 8 June, WAM M15272, 107-110. (iii) 165 km E Derby 17°6' 125°10', 4 ♂, 5 ♀, 15-17 May, WAM M15273-M15286. (iv) 165 km E Derby, 17°7' 125°10', 3 ♂, 6 ♀, 15-17 May, 101, 104, 105, 543-548. (v) West Bastian above Wyndham, 5°27' 128°21', 1 ♂, 1 ♀, 27 May, WAM M15287, 100. *N.T.* (vi) 346 km S Dar-

win, 15°36' 131°8', 1 ♀, 31 May, 99. (vii) Nourlangie Rock, 230 km E Darwin, 12°51' 132°47', 1 ♂, 1 ♀, 13 June, 97, 98.

Notes: The habitat of *Z. argurus* cannot be described by Specht's classification. This animal occasionally occurs on rocky slopes covered with sparse vegetation as in locality (iv) but more often in rock piles devoid of vegetation (i, ii, iii and v).

Reproduction: (i) Copulation plug present, (vi) embryos in uterus.

Ectoparasites: (i, ii, iii, iv) *Laelaps pammorphus*, (i) *Echidnophaga myrmecobi*.

39. *Zyzomys woodwardi*, Large Rock-rat

Localities: *N.T.* (i) Nourlangie Rock, 230 km E Darwin, 12°51' 132°47', 3 ♂, 2 ♀, 2, 13 and 18 June, SAM M9899, 113-115. (ii) Cannon Hill 225 km E Darwin, 12°23' 132°56', 4 ♀, 21 June, 116-118, 549.

Notes: Both localities are outlying scarps of the Arnhem Land Escarpment.

Ectoparasites: (ii) *Laelaps pammorphus*.

40. *Mustacomys fuscus*, Broad-toothed rat

Locality: *N.S.W.* (i) Kosciusko Natl Pk, 36°23' 148°28', 4 ♀, 10-11 Feb., SAM M9897, AM M10431, M10432, 77.

Notes: This locality is a closed herbfield.

Reproduction: (i) 1 young born.

Ectoparasites: (i) *Laelaps cybiala*, *Macropsylla hercules*, *Pygiopsylla hoplia*.

41. *Pseudomys delicatulus*, Little Native-mouse

Localities: *Qld* (i) 22 km SW Emerald, 23°41' 148°4', 2 ♂, 15 Dec., QM 2133, 14. *W.A.* (ii) 189 km S Broome, 19°0' 121°14', 1 ♀, 11 May, 59. *N.T.* (iii) 185 km E Darwin, 12°41' 132°55', 1 ♀, 15 June, SAM M9898.

Notes: Caught in low woodland (i) tall open shrubland/hummock grassland (ii) and low open woodland.

Reproduction: (iii) 3 young born.

42. *Pseudomys novaehollandiae*, New Holland Mouse

Localities: *N.S.W.* (i) 30 km NE Newcastle, 32°39' 152°9', 2 ♂, 4-9 Feb., AM M10433. *Vic.* (ii) 38 km E Sale, 38°6' 147°31' 1 ♀, 23 Feb., 550.

Notes: Caught in closed scrub (i) and low open woodland/open heath (ii).

Reproduction: (ii) 5 embryos in uterus.

43. *Pseudomys albocinctus*, Ashy-grey Mouse

Localities: *W.A.* (i) 22 km NE Jurien, 30°8' 115°9', 2 ♂, 2 ♀, 12-13 Apr., WAM M15295, 25-27. (ii) Bernier Island, 24°56' 113°9', 2 ♀, 21-22 Apr., 28, 29.

Notes: Caught in closed heath (i) and low shrubland on coastal dunes (ii).

Reproduction: (ii) 4 young born.

Ectoparasites: (i) *Laelaps* sp.

44. *Pseudomys occidentalis*, Western Mouse

Localities: *W.A.* (i) 17 km NE Bending, 32°22' 118°28', 3 ♀ 2 ♂ 3, 30-31 Mar., and 1 Apr., WAM, M15294, M15305, 551, 552. (ii) 17 km NE Bending, 32°21' 118°28', 1 ♂, 1 Apr., 553.

Notes: Caught in areas of tall shrubland.

Ectoparasites: (i, ii) *Laelaps* sp., (ii) *Stephanocircus* n. sp.

45. *Pseudomys praeconis*, Shark Bay Mouse

Localities: *W.A.* (i) Bernier Id, 24°56' 113°9', 1 ♂, 21 Apr., WAM M15305. (ii) Bernier Id, 24°55' 113°8', 10♂, 1 ♀, 21-23 Apr., WAM M15306, 19, 554-556.

Notes: Caught in low shrubland (i) and tussock grassland (ii) (Robinson *et al.* 1976).

Ectoparasites: (ii) *Laelaps* sp., (i) *Xenopsylla vexabilis*.

46. *Pseudomys shortridgei*, Shortridge's

Native-mouse

Localities: *Vic.* (i) 42 km NE Hamilton, 37°31' 142°25', 1 ♀, 4 Mar., 466. (ii) 52 km NE Hamilton, 37°27' 142°28', 1 ♀, 7 Mar., 18.

Notes: Caught in areas of closed heath.

47. *Pseudomys gracilicaudatus*, Eastern Chestnut Native-mouse

Localities: *Qld* (i) 8 km SW Townsville, 19°20' 146°4', 2 ♀, 8 Dec., QM 703. (ii) 26 km NE Rockhampton, 23°19' 150°45', 2 ♂, 17-21 Dec., QM 727. (iii) 9 km NE Rockhampton, 23°20' 150°35', 1 ♀, 8 Jan., QM 2120. (iv) 98 km NW Bundaberg, 24°31' 151°28', 1 ♀, 10 Jan., QM 2119.

Notes: Caught in open grassy woodland (i), low grassy woodland (ii and iii) and low open forest (iv).

Ectoparasites: (iv) *Laelaps aella*, *L. nuttalli*.

48. *Pseudomys nanus*, Western Chestnut

Native-mouse

Localities: *W.A.* (i) 165 km E Derby, 17°6' 125°10', 4 ♂ 2 ♀, 1, 15-17 May, WAM M15297, M15300, M15301, 435, 557-559. (ii) 246 km E Derby, 17°7' 125°43', 2 ♂, 1 ♀, 21 May, WAM M15302, 439-440. (iii) 18 km NE Kimberley Research Station, 15°33' 128°6', 1 ♀, 28 May, 444. *N.T.* (iv) 346 km S Darwin, 15°36' 131°7', 1 ♀, 1 June, 445. (v) 7 km SE Nourlangie Camp, 12°49' 132°42', 1 ♀, 13 June, 255. (vi) 14 km S Nourlangie Camp, 12°54' 132°38', 1 ♀, 18 June, 473. (vii) 10 km S Nourlangie Camp, 12°51' 132°41', 1 ♀, 20 June, 478.

Notes: Caught in closed tussock grassland (i, iii and iv), open woodland/closed tussock grassland

(i and ii) and low grassy woodland (v, vi and vii).

Reproduction: (i, iii) Independent juveniles trapped, (iv, vi) 3 young born.

Ectoparasites: (i, ii, iii, iv, v, vi) *Laelaps aella*.

49. *Mus musculus*, House-mouse

Localities: *Qld* (i) 32 km W Windorah, 25°20' 142°18', 1, 16 Oct. (ii) 2 km NE Mt Isa, 1, 19 Oct. (iii) 25 km N Atherton, 17°3' 145°26', 10, 21 Nov. (iv) 11 km NE Atherton, 17°12' 145°33', 2, 21 Nov. (v) 22 km SW Emerald, 23°41' 148°4', 2, 14 Dec. (vi) Nogoia River, Emerald, 23°32' 148°10', 5, 15 Dec. (vii) 26 km NE Rockhampton, 23°19' 150°45', 2, 19 Dec. (viii) 58 km N Maryborough, 25°6' 152°33', 2, 14 Jan. *N.S.W.* (ix) 20 km SW Port Macquarie, 31°37' 152°50', 2, 2 Feb. (x) 50 km NE Newcastle, 32°39' 152°9', 2, 4 Feb., AM M10421. (xi) 20 km NE Murrumbidgee, 37°27' 149°57', 1, 17 Feb. *Vic.* (xii) 38 km E Sale, 38°6' 147°31', 15, 23-24 Feb. *W.A.* (xiii) 17 km NE Bending, 32°22' 118°28', 22, 30 Mar.-1 Apr. (xiv) 32 km S Hyden, 32°49' 119°, 7-10 Apr. (xv) 22 km NE Iurien, 30°8' 115°9', 2, 12 Apr. (xvi) 18 km N Roebourne, 20°37' 117°11', 2, 9 May.

Notes: *M. musculus* was both widespread and common. It was caught in tussock grassland (i), coastal dunes (xii), grassy woodland (ii and viii), closed grassland (iii, iv, v and vi), low grassy woodland (vii), closed scrub (ix), open forest (x), woodland/closed heath (xi), closed heath (xi) and tall shrubland (xii and xiii).

50. *Uromys caudimaculatus*, Giant White-tailed Rat

Localities: *Qld* (i) 23 km SW Portland Roads, 12°44' 143°14', 1 ♂, 31 Oct., 184. (ii) 19 km SW Portland Roads, 12°43' 143°17', 1 ♂, 1 ♀, 2 Nov., 182, 183. (iii) 32 km S Cooktown, 15°45' 145°18', 3 ♂, 1, 7-9 Nov. (iv) 22 km S Cooktown, 15°39' 145°13', 1 ♂, 3 ♀, 5, 7-9 Nov., QM 696. (v) 22 km S Cooktown, 15°39' 145°14', 1, 9 Nov. (vi) 40 km SE Cairns, 17°15' 145°56', 1 ♂, 1 ♀, 15-16 Nov., QM 2095, 191. (vii) 19 km SE Atherton, 17°25' 145°31', 6♂, 1 ♀, 25 Nov., QM 2096, 188, 190. (viii) 3 km SE Atherton, 17°20' 145°30', 1, 27 Nov. (ix) 14 km E Atherton, 17°15' 145°37', 1 ♀, 28 Nov.

Notes: All localities were in closed forest except locality (iv) where it was caught among boulder heaps close to patches of closed forest.

Reproduction: (ii) 1 young born.

Ectoparasites: (ii, vi, vii) *Laelaps southcottii*, (ii) *Odontacorus* sp., (vii) *Pygiopsylla hoplia*.

51. *Melomys cervinipes*, Fawn-footed

Melomys

Localities: *Qld* (i) 26 km SW Portland Roads, 12°44' 143°14', 2, 30 Oct. (ii) 32 km S Cooktown, 15°45' 145°15', 3 ♂, 3 ♀, 7-9 Nov. (iii)

40 km SE Cairns, 17°15' 145°56', 3 ♀, 15-16 Nov. (iv) 41 km SE Cairns, 17°15' 145°56', 1 ♀, 15 Nov. (v) 19 km SE Atherton, 17°25' 145°31', 1 ♀, 25 Nov. (vi) 3 km SE Atherton, 17°20' 145°30', 1, 27 Nov. (vii) 22 km S Atherton, 16°28' 145°59', 1, 1 Dec. (viii) 61 km N Rockhampton, 22°51' 150°40', 1 ♀, 5 Jan. (ix) 98 km NW Rumburg, 24°32' 151°28', 1 ♀, 12 Jan. (x) 38 km E Kingaroy, 26°39' 152°13', 1, 16 Jan. Notes: All localities were closed forest.

Ectoparasites: (ii, iii) *Laelaps nuttalli*, (ii, iii, iv, v, viii, ix) *L. rothschildi*, (v) *Acanthopsylla incerta*, (ix) *A. pavida*.

52. *Melomys littoralis*, Grassland Melomys

Localities: Qld (i) 20 km SW Portland Roads, 12°44' 143°16', 1 ♂, 1 Nov. (ii) 19 km SW Portland Roads, 12°43' 143°17', 1 ♀, 1 Nov. (iii) 21 km SW Portland Roads, 12°44' 143°16', 2 ♀, 1 Nov. (iv) 23 km S Portland Roads, 12°47' 143°18', 3 ♂, 4 ♀, 2-3 Nov., QM 722. (v) 37 km S Cooktown, 15°48' 145°15', 1 ♂, 1 ♀, 2 Nov. (vi) 22 km S Cooktown, 15°39' 145°13', 3 ♂, 1 ♀, 7-8 Nov. (vii) 17 km S Cairns, 17°5' 145°47', 3 ♂, 3 ♀, 14 Nov. (viii) 25 km N Atherton, 17°3' 145°26', 1 ♂, 1 ♀, 21 Nov. (ix) 11 km NE Atherton, 17°12' 145°33' 1 ♂, 1 ♀, 22 Nov. (x) 22 km SE Atherton, 17°22' 145°33', 4 ♂, 4 ♀, 29 Nov. (xi) 29 km SE Innisfail, 17°46' 146°7', 1 ♂, 3 Dec. (xii) 61 km N Rockhampton, 22°52' 150°41', 2, 5 Jan. (xiii) 58 km N Rockhampton, 22°52' 150°41', 1 ♂, 1 ♀, 5 Jan. (xiv) 58 km N Maryborough, 25°6' 152°32', 1 ♀, 14 Jan. (xv) 9 km SE Dunwich, North Stradbroke Is., 27°32' 153°30', 3 ♂, 19-20 Jan. N.T. (xvi) Nourlangie Camp (205 km E Darwin), 12°46' 132°40', 1 ♂, 19 June. (xvii) 15 km NE Darwin, 12°22' 130°56', 1 ♂, 11 June.

Notes: Habitats were closed forest (xvi), open forest (xi, xii), low open forest/grassy woodland (i, ii, iii, iv, xiii, xiv), low grassy woodland (v, vi), low open grassy woodland (vii), closed grassland (viii, ix), closed sedgeland (x, xv, xvii).

Ectoparasites: (vi, xvii) *Laelaps nuttalli*, (i, iii, iv, v, vi, vii, viii, ix, xi, xiii, xiv, xv, xvii) *L. rothschildi*, (ix, xv) *Mesolaelaps australiensis*, (vii, ix, x, xiv, xv) *Pygiopsylla hoplla*, (x) *P. sp.*, *Acanthopsylla incerta*, *A. pavida*, *Xenopsylla australiaca*, (iv, ix) *X. vexabilis*.

53. *Melomys* spp.

Localities: Qld (i) 62 km NW Coen, 13°27' 142°57', 1 ♀, 29 Oct., QM 709. (ii) 19 km SE Atherton, 17°25' 145°31', 1, 25 Nov., QM 721.

Notes: Habitats were riverine closed forest (i) and closed forest (ii).

Ectoparasites: (i) *Laelaps rothschildi*, (ii) *Pygiopsylla sinuata*, *Acanthopsylla incerta*, *A. pavida*, *Xenopsylla australiaca*.

Discussion

The results contain some significant distribution records.

The Plague Rat *Rattus villosissimus* collected 26 km SE of Wyndham is the second and most northerly record from Western Australia (Calaby 1974).

The Common Rock-rat *Zygomys argutus*, a relatively common species in suitable habitat in northern Australia, was collected 22 km S of Cooktown, which is the fourth and most northerly record from Queensland (Tate 1952; Gordon & Johnson 1973).

The Little Native-mouse, *Pseudomys delicatulus*, collected 189 km S of Broome, is one of the most southerly records for this species in Western Australia (Bannister 1969). The record from Emerald, Queensland is further inland than previous published records (Covačevič & Easton 1974).

The Eastern Chestnut Native-mouse, *Pseudomys gracilicaudatus*, has recently "reappeared" near Townsville (Borsboom 1975), Emerald (Taylor & Horner (1973) misidentified as *P. australis* c.f. Mahoney & Posamentier (1975)) and north coastal N.S.W. (Mahoney & Posamentier 1975). Our data add three more localities in coastal Queensland. This widely distributed species appears to occur at a uniformly low population density, and considerable trapping effort has usually been expended in its capture (Mahoney & Posamentier 1975). For comparison the trapping effort to capture this species in the present study was: locality (i) 60 trap nights, locality (ii) 330 trap nights, locality (iii) 60 trap nights and locality (iv) 219 trap nights. It is, however, necessary to take into account seasonal variations in population density and this is clearly not possible in a study such as this. As an example, Tunney's Rat *Rattus tunneyi culmorum* proved to be extremely difficult to capture, an experience also recorded by Taylor & Horner (1973). One specimen was trapped at each of three localities in coastal Queensland but many other localities were trapped in the hope of capturing this rodent. One of these was Archocoora State Forest, a Hoop Pine plantation in southern Queensland where at certain times of the year *R.t. culmorum* is abundant and causes extensive damage to the Hoop Pine root systems (Taylor & Horner 1973). Although numerous signs of this species were seen in the area no rats were captured.

Two major generalisations regarding the Australian rodent fauna can be made as a

TABLE 1

Trapping success for all species, including introduced species, in the major habitat types sampled in eastern, western and northern Australia

Habitat	Number of trap localities	Total trap nights	Number of captures	Trapping success (%)
Closed forest	17	980	99	10.1
Tall open forest	2	138	55	39.9
Open forest	9	815	88	10.8
Woodland	17	2010	180	9.0
Shrubland	6	765	83	10.8
Heath	7	1070	112	10.5
Tussock grassland	10	718	64	8.9
Sedgeland	4	520	46	8.8
Rockpiles	9	850	65	7.6

result of this study covering a large proportion of the habitat types over a wide area of Australia:

(1) The trapping success in this study (8.3%) supports Watts' (1974) comment that population densities of Australian rodents are low in comparison with equivalent habitats in the Northern Hemisphere. The highest trapping success achieved was 55% in the Otway Ranges, Victoria. Table 1 provides a broad outline of the variation in trapping success in the major habitat types sampled. The two areas of tall open forest sampled proved to support a substantially higher density of small mammals than any of the other habitats. This trend is supported by trapping experience (A. C. Robinson unpublished data) in other areas of this habitat in Victoria.

(2) Australian small mammal faunas are characterised by the low number of species that occur sympatrically. In this study sympatric occurrence was defined as occurrence on the same 200 m trapline, bearing in mind that attempts were made to keep each trapline in a single major habitat.

Of thirty-nine instances of sympatry noted the largest number of species occurring together was four (Table 2). Most cases involve species occupying obviously different ecological niches by virtue of such factors as:

(a) size differences, e.g. *Rattus leucopus*, *Uromys caudimaculatus*, (b) above ground nests compared with burrows, e.g. *Melomys littoralis*, *R. sordidus*, (c) insectivorous marsupials compared with omnivorous rodents, i.e. *Antechinus stuartii*, *R. fuscipes*, (d) introduced species with native species, e.g. *Mus musculus*, *Pseudomys occidentalis*. Only three cases which may indicate some degree of com-

TABLE 2

Small mammal species occurring together in the same 200 m trapline. Most abundant species shown first; locality number refers to this species in the body of the paper

Locality	Sympatric species
28(v)	<i>Rattus villosissimus</i> , <i>Mus musculus</i>
29(i)	<i>R. leucopus</i> , <i>Uromys caudimaculatus</i>
26(i)	<i>R. sordidus</i> , <i>Melomys littoralis</i> , <i>Sminthopsis rufigenis</i>
38(i)	<i>Zygomys argurus</i> , <i>U. caudimaculatus</i> , <i>M. cervinipes</i>
26(iv)	<i>R. sordidus</i> , <i>M. littoralis</i> , <i>R. rattus</i>
33(iii)	<i>M. cervinipes</i> , <i>U. caudimaculatus</i> , <i>R. rattus</i>
24(ii)	<i>R. fuscipes</i> , <i>M. cervinipes</i>
26(vi)	<i>R. sordidus</i> , <i>R. rattus</i> , <i>Mus musculus</i>
51(v)	<i>M. cervinipes</i> , <i>U. caudimaculatus</i>
24(i)	<i>R. fuscipes</i> , <i>U. caudimaculatus</i>
26(v)	<i>R. sordidus</i> , <i>M. littoralis</i>
11(iv)	<i>Isoodon macrourus</i> , <i>Pseudomys gracilicaudatus</i>
32(i)	<i>R. tunneyi</i> , <i>Mus musculus</i>
32(i)	<i>Mus musculus</i> , <i>P. delicatulus</i>
32(ii)	<i>R. tunneyi</i> , <i>M. littoralis</i>
47(iii)	<i>P. gracilicaudatus</i> , <i>M. littoralis</i>
12(i)	<i>Perameles nasuta</i> , <i>M. cervinipes</i>
11(vi)	<i>I. macrourus</i> , <i>M. littoralis</i> , <i>R. rattus</i>
25(ii)	<i>R. lutreolus</i> , <i>Antechinus stuartii</i> , <i>I. macrourus</i>
33(ix)	<i>R. rattus</i> , <i>P. novaehollandiae</i>
33(ix)	<i>R. rattus</i> , <i>R. fuscipes</i>
23(iv)	<i>R. fuscipes</i> , <i>A. swainsonii</i> , <i>Mastacomys fuscus</i>
23(v)	<i>R. fuscipes</i> , <i>A. swainsonii</i> , <i>A. stuartii</i>
23(vii)	<i>R. fuscipes</i> , <i>A. stuartii</i> , <i>Mus musculus</i>
23(xi)	<i>R. fuscipes</i> , <i>A. stuartii</i> , <i>A. swainsonii</i> , <i>Potorous tridactylus</i>
49(xii)	<i>Mus musculus</i> , <i>P. novaehollandiae</i>
25(vii)	<i>R. lutreolus</i> , <i>A. stuartii</i> , <i>I. obesulus</i>
23(xii)	<i>R. fuscipes</i> , <i>A. stuartii</i> , <i>A. swainsonii</i>
23(xiii)	<i>R. fuscipes</i> , <i>A. stuartii</i> , <i>A. swainsonii</i>
16(viii)	<i>A. stuartii</i> , <i>R. lutreolus</i> , <i>A. swainsonii</i>
25(x)	<i>R. lutreolus</i> , <i>P. shorridgeti</i>
49(xiii)	<i>Mus musculus</i> , <i>P. occidentalis</i>
45(i)	<i>P. praecox</i> , <i>P. albocinereus</i> , <i>Perameles bougainville</i>
31(i)	<i>R. tunneyi</i> , <i>P. nanus</i>
31(iv)	<i>R. tunneyi</i> , <i>P. nanus</i>
31(v)	<i>R. tunneyi</i> , <i>R. villosissimus</i>
27(ii)	<i>R. colletti</i> , <i>M. littoralis</i>
31(xii)	<i>R. tunneyi</i> , <i>M. littoralis</i>
17(v)	<i>A. bellus</i> , <i>I. macrourus</i> , <i>Dasyurus hallucatus</i>

petition between species were noted. (a) In locality 26(iv) 17 km S of Cairns, Qld, *R. rattus* and *R. sordidus* occurred together. This was an area of disturbed open woodland ad-

adjacent to cane fields and may have represented an unstable situation. (b) In locality 33 (ix) 50 km N of Newcastle, N.S.W., *R. rattus* and *R. fuscipes* occurred together. Again this was an area of open forest adjacent to heathlands regenerating from sand mining and may have been an unstable situation. (c) In locality 31 (v) 26 km E of Wyndham, W.A., *R. tunneyi* and *R. villosissimus* occurred together. This was the edge of a flood plain supporting a closed tussock grassland adjacent to an open grassy woodland and may have been part of an ecotone.

Some previously unknown forms of ectoparasites were collected and some considerable range extensions were recorded. The fleas included a new *Stephanocircus* from *P. occidentalis*, a new *Pygiopsylla* from *R. f. assimilis* and a new subspecies of *Pygiopsylla rainbowii* from *R. rattus* and *R. sordidus*. The mites included a new *Laelaps* from *P. occidentalis*, a new *Laelaps* from *P. praeconis* and possibly also *P. albocinereus*.

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